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This paper is to transmit a translation of a foreign language reference relied on in a rejection in this application, specifically German document 24 06 313 to Mays.

Attachment: Translation of DE 24 06 313

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German Patent
Document No. 24 06 313

PRESSURE REDUCING APPARATUS

[Druckmindervorrichtung]

Hal Mays

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/1[1]

"PRESSURE REDUCING APPARATUS"

The invention concerns a pressure reducing valve that is particularly suitable for use in high pressure gas tanks, for example, oxygen bottles.

The fundamental object of the invention is the creation of a pressure reducer that is simpler and more economic to produce than those known until now.

It is also an object of the invention to create a highly effective compact pressure controller that can be used, for example, together with a high pressure oxygen tank, in order to make possible the combination of the low pressure element with a gas, possibly acetylene, propane, or other gases suitable for welding, soldering, or the like. The invention should make possible a lowering of the production costs of a welding or soldering device in order to make it affordable for amateurs.

It is also an object of the invention to create a device that comprises a pressure controller and a high pressure closure

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fitting, which can be mounted on the neck of a pressure cylinder, wherein the pressure controller is defined to coact

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[1] Numbers in the margin indicate pagination in the foreign text.

with the fitting in such a way that the latter is opened if the controller is adjusted for the release of the medium at a predetermined low pressure.

It is another object of the invention to create an apparatus that is suitable for the oxygen-gas welding device and is sufficiently accurate in its pressure control to suffice for the needs of a user, which may be different from those of a professional, and which at the same time is robust in construction and mode of operation in order to ensure its reuse on other high pressure tanks with differently high pressures without endangering the user.

Other object and advantages of the invention are explained in the following description of the drawings, which depict an exemplary embodiment of the invention, wherein:

Fig. 1 shows the high pressure gas tank in dismantled condition, the corresponding outlet fitting with cover, and the controller connected to the closure fitting,

Fig. 2 shows a section along the line 2-2 of Fig. 1 in the assembled working state, and

Fig. 3 shows a cross section along the line 3-3 of Fig. 2.

The invention is defined for use in high pressure sources, for example, the pressure gas bottle 1, which has a neck 2 with an

inner thread 3. Into the latter is screwed in an end of an outlet fitting 4, which has a central bore 5 and a narrower bore 6, which is coaxial thereto. Between these bores is provided a seat 7 for a sphere 8, which is constantly pressed by the pressure spring 9 against the seat 7. The end of the pressure spring 9 opposite the sphere 8 is supported on the nipple 10,

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which screws into the inlet end of the bore 5, and has a central passage 11, through which the high pressure medium passes from the pressure gas bottle 1 into the bore 5, 6.

The cylindrical spacing pin 15, which has a diameter that is narrower by a thousandth of a millimeter, is guided with a sliding motion within the narrower bottle 6 of the fitting 4. The latter separates the sphere 8 from a second thinner sphere 16, which rests on the seat 17. An even narrower bore 18, through which the pressure medium reaches the pressure controller 20 is provided starting from the seat 17. As explained later, the high pressure medium in the pressure cylinder 1 is normally blocked by the spheres 8, 16, which press these against their seats due to the spring 9 and the very high pressure in the bore 5. The spacing pin 15 must, of course, be cut exactly to length in order to achieve the simultaneous fit of the two spheres on their seats. The extraordinarily high

pressure that is exerted on the sphere seats will compensate indeed for any inaccuracy, in particular if the spheres 8, 16 and the spacing pin 15 are made of very hard material, such as hardened steel, and the sphere seats are made of a relatively softer material, such as brass or aluminum. The utilization of two spheres causes a strong increase of the throttling within restricted boundaries.

The pressure controller 20 has an elongated housing 21, whose cross section is not circular, but, for example, hexagonal, in order to facilitate the screwing into the fitting 4, which has preferably a similar cross section for fitting a monkey wrench. On the fitting 4 is provided an outer thread 23, via which the housing 21 can be detachably connected to the fitting 4, as is shown in Fig. 2. The end of the fitting 4 to be connected to the controller 20 has a planar end face 24, which rests against the bottom 25 of the threaded opening 26, in which the fitting 4 is accommodated in the assembled state of the parts 4 and 20. A circular-shaped groove 28, into which is installed an O-ring 29

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that seals the connection against leakage losses, is provided in the bottom 25 in order to achieve a sealing closure.

A somewhat wider bore 30, which is coaxial with respect to the central axis of the housing 21, is provided in the housing and

is axially aligned with respect to the outer bore 18 of the fitting 4. This bore 30 forms a central passage, which passes into an expanded cylinder bore 31 at the inner end, which accommodates a piston 32 in sliding motion. Piston leakage losses are prevented by means of the O-rings 33, 34.

At the outer end of the housing 21, said housing is provided with a screw head 36, which is screwed into the free end of the cylinder bore 31.

The screw head 36 has a central bore 40, in which is installed a pressure spring 41, which presses the piston 32 in the direction toward the fitting 4. The pressure spring 41 is supported with the outer end on a lug 42, which can be adjusted by screwing via the thread 43, and has mainly an inner hexagon for accommodating a wrench. The force exerted by the spring 41 on the piston 32 can be adjusted by screwing the lug 42.

The piston 32 has an extension 46, which is preferably made of a hardened material, such as steel, and is installed in a gas-tight manner in the piston 32. The extension 46 extends into the bore 30 and is a few thousandth of a millimeter narrower in diameter than the bore 30, so that a throttling effect is created within the annular space, which encloses the extension 46 and leads into the cylinder bore 31. At the outer end, the extension 46 is reduced in diameter, so that a free end 47 is

created, which is accommodated with unimpeded sliding mobility in the bore 18 of the fitting 4. The force of the spring 41 can be adjusted in such a way by screwing the lug 42 /5 provided with a thread 43, that the valve formed by the parts 8 and 16 is opened if the motion of the piston 32 is sufficient to press the free end 47 of the extension 46 on the sphere 16. It is also ensured that the annular spaces around the spheres 8 and 16 as well as the annular space between the spacing pin 15 and the bore 6 effect a throttling of the high pressure gas. Between the ends of the bore 30, said bore is cut by an outlet 50 (Fig. 3), into which the throttled medium passes from the annular space between the extension and the bore 30. The outlet 50 is expanded in order to form a seat 51, which coacts with the needle tip of a needle valve 52, which may be closed. To the needle valve 52 belongs a screw, which is secured via a thread in a socket 53, which is screwed in turn into a threaded opening 54 in the housing 21. The thread at the screw 52 should extend only over part of its total length, so that the inner screw end is cylindrical and is sealed via an O-ring 56 in the socket 53. An outlet 58, which serves as outlet for the medium whose pressure has been reduced, is connected to the expanded part of the outlet 50, and this outlet connects to a suitable line 60, which is secured in the housing 21, as can be seen best in Fig.

3. The line 60 guides the medium, whose pressure has been reduced, for example, to a welding device or another device connected thereto.

If it is ensured that the pressure in the cylinder bore 31 is essentially the same as in the outlet 50, then it would be possible to connect the inner end of the cylinder bore 31 to the outlet. The shown embodiment is, however, more advantageous, because the additional material of the housing 21, which encloses the bore 30, offers more space for attaching the outlet of Fig. 3.

If the low pressure medium is to be released, then only the /6 inward screw of the threaded lug 42, 43 is required until the valve closed by the spheres 8, 16 is opened, so that the high pressure medium passes into the bore 30 and is subjected to the aforementioned throttling effect. It should be noted that the medium pressure on the piston 32 acts against the force of the spring 41, which induces the outward motion of the piston 32, until the valve and fitting 4 close.

An extraction of the low pressure gas by opening the needle valve 51 is effected during a slight pressure reduction in the cylinder bore 31, so that the valve in the fitting 5 can be opened again. However, a compensated state in which the balls 8, 16 are removed sufficiently far away from their seats can be

established by adjusting the threaded lug 42, 43 in order to supply the desired medium quantity, which acts on the piston 32 in such a way during throttling that said piston remains balanced with respect to the spheres 8, 16, which are not located on their seats.

If the gas extraction is no longer necessary, all that is required is a closing of the needle valve 52, and the device is ready again for further use. If, on the other hand, the controller 20 and the fitting 4 should be separated, then the threaded lug 42, 43 must only be screwed back, which effects the closure of the valves in the fitting 4. After the separation of the controller 20 from the fitting 4, there is still a small quantity of low pressure medium in the housing 21. However, since the two parts are unscrewed, the O-ring 29 rests no longer on the end face 24 of the fitting 4, whereby it is possible for the gas to escape along the thread 23.

Another safeguard can be achieved by measuring the thread 23 to be so long that even if the operator does not screw back the threaded lug 42, 43, the spheres 8, 16 are pressed into their closed position before they detach completely from the thread 23. /7

It can be seen that the coaxial arrangement of all parts leads to an economic, robust pressure reducer, which can be configured

sufficiently simple in order to hold together the fitting 4 with the bottle 1, if this is desired.

Before assembling the pressure control part 20 with the fitting 4, its outer thread can be protected by means of a cover 62 during shipping and handling (Fig. 1). In this case, it is advantageous to provide an O-ring for the case of a possible leakage loss at the spheres 8, 16 between the cover 62 and the fitting 4.

As previously explained, an unrestricted freedom exists between the extension 47 and the bore 18, so that the extension 47 penetrates with security into the bore 18 during assembly, despite the play between the thread 23 and the tread opening 26. For this reason, if at all, a low throttling will occur around the extension 47. The throttling that takes place is therefore dependent from the spheres 8, 16, the spacing pin 15, and the extension 46.

For the result produced by the invention is extraordinarily important the utilization of two spheres in the fitting 4, because a relatively high throttling and a great pressure reduction can take place within a small space. Even though it appears as if the simultaneous fitting and lifting off of the spheres from their seats or seats can cause difficulties from the point of view of the production, the practice shows that

careful a measuring and compressing of the sphere with a relatively great force does indeed lead relatively easily to the desired result. As was mentioned before, the utilization of relatively soft material, such as brass and aluminum, assists the seats in achieving the desired results.

The two spheres 8, 16 and the spacing pin 15 located closely /8 between them form equally a single component with a somewhat complex form, which could also be utilized to retain the combined advantages, which are created by the multiple seat surfaces, and in order to keep the throttling advantages of several accurately defined opening and annular spaces [connected] in series, which are located axially between the high pressure source and the element responsible for the low pressure. The essential function is that the pressure reduction at the openings is responsible for the position of the low pressure sensing element during the passage of the medium, and the pressure reduction throughout the constant annular space is responsible for the throughput portion. As a consequence of this is achieved an accurate control of a large total pressure reduction with a relatively small low pressure sensing element. The throughput quantity for the application following the controller is thus adjusted very easily and can be kept constant

thereafter and namely without further adjustment of the threaded lug 42/43 or the needle valve 52.

Regardless of which venting is conveyed for the space in which the spring 41 is accommodated, this is made possible by leakage behind the thread of the screw head 36 and the thread 43. /9

Claims

1. A pressure reducing apparatus, wherein a valve that can be exposed to the high pressure medium has an inlet (5) and two mutually axially spaced seats, two valve closing parts, and a spacing element between the valve closing parts, wherein the spaces that enclose the closure parts and the spacing element form throttling gaps.
2. The pressure reducing apparatus of claim 1, wherein the valve closing parts are configured as spheres (8, 16) and spring elements (9) are present, which press the spheres (8, 16) against their seats.
3. The pressure reducing apparatus of claims 1 and 2, wherein the valve with the inlet is configured as a fitting (4) connected to a high pressure source (1) with outlet (18) and is normally blocked, and is mounted on the fitting (4) of the housing (21) of a pressure controller (20) with a passage (30), which connects, on the one hand, to the outlet (18) of the fitting (4), and on the other hand, passes into a

cylinder bore (31), which accommodates a piston (32) having a sliding motion with an extension (46) affixed thereon, which projects into the passage (30) while forming a throttle gap, wherein the free end (47) of the extension (46) projects into the outlet (18) of the fitting (4), and a low pressure outlet (58) is provided in the controller housing (21), which cuts into the throttle gap at the passage (30), and spring elements (41) and the free end (47) press against the closing part of the valves in the sense of an opening thereof, so that the low pressure medium in the throttle gap counteracts the spring forces on the piston (32), in order to bring this piston (32) into a position with respect to the valve in which the throughput is controlled.

4. The pressure reducing apparatus of one or several of the preceding claims, wherein the one sphere (8) has a considerably greater diameter than the other sphere (16).

5. The pressure reducing apparatus of one or several of the preceding claims, wherein the spacing element is configured as a spacing pin (15), whose cross section is somewhat less than the width of the passage (30) in order to form a

throttle gap.